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ESBL/AmpC positive family member and child day-care attendance increase the risk for ESBL/AmpC carriage

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Introduction

- The increasing prevalence and diversity of ESBL/AmpC producing *Enterobacteriaceae* resistant to third-generation cephalosporins is an emerging public health concern (1)
- Risk factors for ESBL/AmpC carriage have been investigated mainly in hospitalized patients and in adults (2)
- There is a paucity of original data on the prevalence and risk factors for ESBL/AmpC carriage in preschool children and their parents

References:
1 *Coque T.M. et al. Eurosurv. 2008;13:1–11.*
2 *Lukac P.J. et al. Clin Infect Dis. 2015;1-9.*

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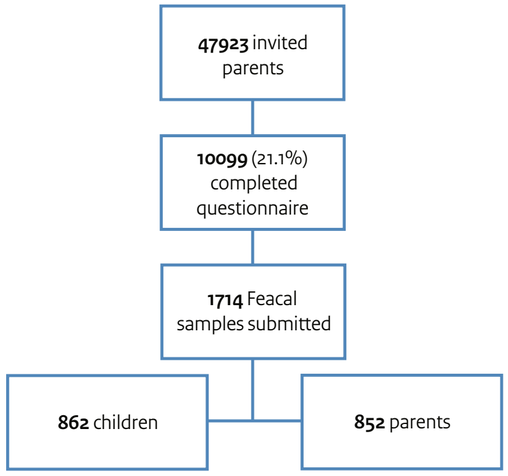

Figure 1: Invitation and response

Aim

To determine:
1. the prevalence and risk factors for ESBL/AmpC carriage in preschool children and their parents in the Netherlands
2. the association between ESBL/AmpC carriage in children and their parents

Methods

Data collection:
- A repeated, cross-sectional survey in Dutch households with young children was carried out during 2012-2014
- ~2000 preschool children were drawn monthly from Dutch population registries. Parents filled in a questionnaire and provided a faecal sample from one parent and the invited child living in the same household (Figure 1)

Laboratory:
- Faecal samples were enriched in 3 ml Luria Bertani broth with 1 mg/L cefotaxime
- MacConkey agar with 1 mg/L cefotaxime was used as a screening medium for extended-spectrum cephalosporin-resistant (ESCR) isolates
- colonies were speciated using MALDI-TOF MS
- For *Escherichia coli*, *Enterobacter cloacae* and *Klebsiella pneumoniae* ESBL/AmpC genes were identified by microarray analysis (Check-MDR CT-101, Check-points, The Netherlands) followed by sequencing

Statistical analysis:
- Logistic regression analysis was used to test whether there was an association between children and parents with regard to ESBL/AmpC carriage
- Multivariable logistic regression models with backward stepwise variable selection was used to identify risk factors for ESBL/AmpC carriage in children and parents.
  A total of 28 putative risk factors were assessed in children and 57 in parents. Models were internally validated using bootstrapping methods
- The variables season of sampling, urbanisation degree, socio-economic status, age and gender were assessed as potential confounders

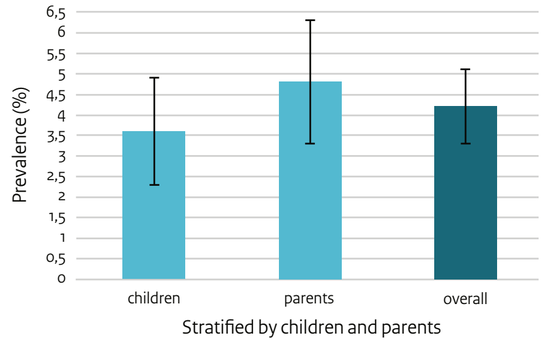

Figure 2: Prevalence of ESBL/AmpC carriage in children and their parents (with 95% confidence intervals)

Results

Prevalence
- In total 65 participants were ESBL positive and five were AmpC positive (30 children and 40 parents)
- ESBL/AmpC prevalence was adjusted for urbanization degree (Figure 2)

Association between ESBL/AmpC carriage in children and parents
- There were 11 child-parent pairs positive for ESBL/AmpC, and 9 pairs shared the same ESBL/AmpC genotypes (Table 1 and 2)
- The association of ESBL/AmpC carriage between children and parents was statistically significant (OR 15.6, 95%CI: 6.8-35.8)

Risk factors
- Child: the most significant risk factor for ESBL/AmpC carriage in children was attending day-care for more than one day a week compared to not attending day-care at all (OR 2.5, 95%CI: 1.1-6.8)
- Parent: having one or more children in the household attending day-care was the most significant risk factor for ESBL/AmpC carriage in parents (OR 2.3, 95%CI: 1.2-5.4)

Table 1: Most commonly genes found in children and parents

Children		Parents	
$bla_{CTX\text{-}M15}$	32.0%	$bla_{CTX\text{-}M15}$	35.9%
$bla_{SHV\text{-}12}$	20.0%	$bla_{CTX\text{-}M1}$	20.5%
$bla_{CTX\text{-}M3}$ and $bla_{CTX\text{-}M14}$	12.0%	$bla_{CTX\text{-}M14}$	12.8%

Table 2: Co-occurrence of ESBL/AmpC genotypes in child-parent pairs

Genotype	Observed co-occurrence	Expected co-occurrence	P-value (binomial probability test)
$bla_{CTX\text{-}M14}$	3	0.0011	<0.001
$bla_{CTX\text{-}M15}$	2	0.0096	0.146
$bla_{CTX\text{-}M3}$	2	0.0005	<0.001
$bla_{SHV\text{-}12}$	1	0.0011	0.077
$bla_{TEM\text{-}52c}$	1	0.0001	0.005
Overall	9	0.0163	<0.001

Conclusions

- ESBL/AmpC prevalence in Dutch households with young children is 4.2%
- Day-care attendance is the main risk factor for ESBL/AmpC carriage in both children and parents
- Having an ESBL/AmpC-positive parent or child is associated with carrying ESBL/AmpC producing bacteria in the corresponding child or parent, and if both child and parent are ESBL/AmpC-positive, then they are likely to share the same genotypes